SUPPLIER PERFORMANCE REPORTING

INVENTOR

Alvin Wong

BACKGROUND OF THE INVENTION

5   This invention relates to a system and method for reporting supplier on-time performance and a system and method for reporting supplier reject performance.

Supplier on-time performance is typically reported as a percentage of orders that are delivered within a specified period of time with respect to a standardized start point and end point. In order to measure the amount of time that a supplier takes to

10   deliver product in response to an order, a "start point," i.e. an event triggering the start of a time period used to measure delivery time, must be identified. An "end point," i.e., an event triggering the end of the time period used to measure delivery time, must also be identified. Typically, the possible start points used for measuring delivery time include: the time at which the buyer placed the order ("order sent" or

15   "OS"), the time at which the supplier received the order ("order received" or "OR"), and the time at which the supplier confirmed the order with the buyer ("order confirmed" or "OC"). Possible end points that might be used for measuring delivery time are, for example, the arrival time of the supplier shipment at one of the following: the customer's receiving dock ("CRD") (note, the terms "customer" and

20   "buyer" are used interchangeably herein); the customer's final destination ("CFD", e.g. customer storeroom, customer assembly line, customer mail stop); the origin

1

transport on board ("OTO", i.e., loaded onto the shipping vehicle at the origin); destination transport onboard ("DTO", i.e. when the shipping vehicle arrives at its destination country); destination customs inbound ("DCI", i.e. arrival at customs in the destination country prior to customs processing); destination customs outbound ("DCO", i.e., point at which customs processing in the destination country is completed); or the supplier shipping dock ("SSD").

Existing supplier performance reporting systems generally pick a single start point and a single end point to use as the standardized start and end points for determining the time period against which to measure whether or not a delivery is "on time." Such systems require users to report on time performance using a standardized start and end point. This approach has at least two disadvantages. First, the customers that are providing on-time delivery data for use by such systems may not ordinarily track delivery times using the standardized start point and end point required by the system. Thus, customers may have to adjust existing internal procedures in order to report delivery time data that is useable by such systems. A second disadvantage of such systems is that customers whose businesses place an importance on delivery times using start and end points different from those used by the reporting system will not be able to gauge the performance of suppliers in a manner that is consistent with the particular business needs of such customers.

Existing supplier performance reporting systems also typically report the percentage of orders that are returned. However, existing systems simply report

"reject performance" as a percentage of total orders that are returned without distinguishing between whether the return was supplier caused or customer caused. In some contexts, it may be useful for users of a supplier performance reporting system to know how many returns were caused by the supplier and how many were

5   caused the customer.

SUMMARY OF THE INVENTION

The present invention addresses some of the problems of prior supplier performance reporting systems. An aspect of a present embodiment receives and

10   processes data to enable reporting of on-time performance relative to a plurality of

(insert)

actual
purchasing
are
01/19/02

order start point / end point pairs. Customers and suppliers report on-time performance for system processing using the delivery start and end points collected in the normal course of their business operations. System users may obtain supplier on-time performance reports indicating the on-time performance of suppliers relative to

15   the plurality of start point / end point pairs reflected in the collected data.

Another aspect of a present embodiment collects transaction information predictive of whether an order reject was supplier caused or customer caused. The predicted cause of order rejects is reflected in supplier reject performance as reported by a system implementing this aspect of the present invention.

20

BRIEF DESCRIPTION OF THE DRAWINGS

The novel features of the invention are set forth in the appended claims.

However, for purpose of explanation, several aspects of an embodiment of the

invention are described by reference to the following figures.

5   **Figure 1** is a system level view of the basic components and data flow in a

system that may be used to implement an embodiment of the present invention.

Figure 2a is a table illustrative of Basic Purchase Order Data provided by a

customer/buyer computer system.

Figure 2b is a table illustrative of Summarized Purchase Order Data stored in

10   system 10 of **Figure 1**.

Figure 3 is a process diagram illustrating steps for converting the Basic

Purchase Order Data of **Figure 2a** into the Summarized Purchase Order Data of

Figure 2b.

Figure 4 is a sample supplier performance report that may be generated by

15   the system of **Figure 1**.

Figure 5 is a process diagram illustrating steps for creating a supplier

performance report from Summarized Purchase Order Data.

Figure 6 is a sample reject performance report that may be generated by the

system of **Figure 1**.

20   **Figure 7** is a flow diagram illustrating the use of transaction data to predict

whether an order reject is supplier caused or customer caused.

DETAILED DESCRIPTON OF THE DRAWINGS

In the following description, numerous details are set forth for purpose of explanation. However, one of ordinary skill in the art would realize that the invention may be practiced without the use of these specific details. In other instances, well-known structures and devices are shown in block diagram form in order not to obscure the description of the invention with unnecessary detail.

Figure 1 shows a system 10 that may be used to implement the present invention. System 10 comprises one or more computers. System 10 includes at least one processing element and at least one memory storage element. The one or more computers of system 10 will have access to executable instruction code in an electronically readable medium (code and medium not separately shown). The electronically readable medium may be any medium that either stores or carries electronic signals (including signals referred to as electrical signals and signals referred to as electromagnetic signals). The executable instruction code in an electronically readable medium directs the illustrated one or more computers to carry out various tasks described herein. The executable code for directing the carrying out of tasks described herein would be typically realized in software. However, it will be appreciated by those skilled in the art, that some computers might utilize code realized in hardware to perform many of the identified tasks without departing from the present invention.

System 10 is communicatively connected (either periodically or continuously) to computer systems at various subscribers including buyers and/or suppliers including systems 11a, 11b, and 11c. System 10 is also be communicatively connected to web portal 12. Web portal 12 is a computer or group of computers that makes information from system 10 available over the Internet to one or more subscribers. Although **Figure 1** illustrates a system that makes supplier performance information available to subscribers over the Internet, supplier performance reports may be generated by system 10 and provided to subscribers through other delivery mechanisms, such as, for example, by fax.

Blocks 10-1 to 10-7 and associated arrows indicate the processing and data flow of system 10. At block 10-1, data is received relevant to either basic purchase order data or summarized purchase order data (see **Figures 2a, 2b,** and **3** and accompanying text) from systems 11a, 11b, and 11c. This basic or summarized data may be received through a periodic batch update process or through a persistent connection that provides real time updating of system 10's stored data. Summarized purchase order data is derived from basic purchase order data using process 30 as illustrated and described in **Figure 3** and accompanying text. That process may be performed either on subscriber system 11a, 11b, and 11c or at system 10. If process 30 is performed on a subscriber system, system 10 will receive summarized purchase order data, if process 30 is performed at block 10-1 of system 10, then system 10 will receive basic purchase order data. Received data, whether summarized or basic, is

converted at block 10-1 for storing in the common data base stored at block 10-3.

Aside from converting any basic data received to summarized data, system 10 also

transforms data using known techniques to ensure data integrity. Those skilled in the

art will recognize that, for example, values relevant to primary keys (i.e. fields whose

5   data uniquely identifies each row) may need to be added to the received data to

ensure that new data added to stored data is uniquely identified in the data base (e.g.,

if incoming summarized data has a field for "record number" and record number

values in received data repeat pre-existing values in a record number field of a stored

table, and if "record number" is a primary key whose values are used to uniquely

10   identify a row, the system will replace received record number values with unique

values for adding the data to the pre-existing stored database). These and other well

known techniques may be performed by system 10, but are not necessarily described

in detail herein so as not to obscure the description of the embodiments with

unnecessary detail.

15   A subscriber may transmit requests to system 10 through web-portal 12.

Requests are received at block 10-7. At block 10-5, a response to the user request is

generated. This generation of a response involves requesting and retrieving

information from data storage block 10-3 as indicated by the arrows between blocks

10-5 and 10-3, and involves performing the processing necessary to generate a

20   suitable data view for display. At block 10-6, the response is returned to the used

through web-portal 12.

Figure 2a shows Basic Purchase Order Data ("Basic Data") 20, exemplary of

basic purchase order data that may exist on the system of the system of a buyer

"GoodCo, Inc." Basic Data 20 includes records 20R-1 to 20R-5 (values 1-5 in the

field labeled "Record No.) and fields 20F-1 to 20F-15 (note 20F-1 is labeled

5 "Supplier Name", 20F-15 is labeled "Buyer Name", and the intervening fields are

labeled as indicated, e.g., "Start Point" field 20F-2, "End Point" field 20F-3, etc.).

Figure 2b shows Summarized Purchase Order Data ("Summary Data") 25

derived from Basic Data 20. Summary Data 25 includes records 25R-1, 25R-2, and

25-R3 (values 1-3 in the field labeled "Record No.") and the following fields:

10 "Record No." field 25F-1, "Supplier Name" field 25F-2, "Start Point" field 25F-3,

"End Point" field 25F-4, "# of POs" (purchase orders) Field 25F-5, "# of Line Items"

field 25F-6, "Orders On-Time" field 25F-7, "Line Items On-Time" field 25f-8, and

"Buyer Name" field 25F-9.

Figures 2a and **2b** show respective Basic and Summarized data in a single

15 table, i.e. in a flat file format. It will be appreciated by those skilled in the art, that

data may be stored in other formats such as, for example, a relational data base.

Thus, Basic Data 20 may be stored in multiple tables as may Summarized Data 25.

For example, alternative embodiments may store summarized data for each supplier

in a separate table. Also, variations on the choice of fields will be apparent to those

20 skilled in the art. To cite but one example, the Start Point field may be combined

with the End Point field into a single start point / end point pair field without any loss

in relevant information. These and other variations will be apparent to those skilled

in the art and it will be understood that such variations do not depart from the spirit

and scope of the present invention.

Figure 3 shows an exemplary process that may be used to derive the

5 Summary Data 25 from the Basic Data 20 of Figure 2. Process 30 has steps 3-1

through 3-8. In step 3-1, a Summarized Data table is created with the indicated

fields. In step 3-2, subsets of data are identified in Basic Data, each record in a subset

having the same supplier name, buyer name, start point, and end point. Each subset

of Basic Data 20 records identified in step 3-2 corresponds to a single record in

10 Summary Data 25 as indicated in step 3-4. Also in step 3-4, for each Summary Data

record created, the Supplier Name, Start Point, End Point, and Buyer name fields are

populated with the data from the corresponding subset identified in step 3-2. For

example, record 25R-1 (record number "1") in Summary Data 25 corresponds to the

subset of records 20R-1, 20R-2, and 20R-3 (record numbers "1", "2", and "3") in

15 Basic Data 20 since those Basic Data records have the same Supplier Name, Start

Point, End Point, and Buyer Name, i.e. "Jane Doe Co.", "OC", "CFD", and "GoodCo,

Inc.". Therefore, the Supplier Name, Start Point, End Point, and Buyer Name fields

of Summary Data 25's record 25R-1 are populated with the respective values: "Jane

Doe Co.", "OC", "CFD", and "GoodCo, Inc."

20 In step 3-3, sub-subsets of Basic Data 20 records are identified from the

subsets identified in step 3-2. In other words, in step 3-3 subsets are identified within

9

each subset identified in step 3-2. The sub-subsets of step 3-3 each share the same purchase order number. Note that Basic Data 20 can have multiple records for a single purchase order (e.g. records 1 and 2 in Basic Data 20).

In step 3-5, the "# of POs" field in Summary Data 25 is populated by, for each subset identified in step 3-2, adding up the number sub-subsets identified in step 3-3, and putting the total in the record of Summary Data 25 that corresponds to the step 3-2 subset of Basic Data 20 whose step 3-3 sub-subsets were totaled. For example, Records 20R-1, 20R-2, and 20R-3 of Basic Data 20 is a subset identified in step 3-2 and thus corresponds to a record in Summary Data 25 (record 25R-1). That subset in turn has two subsets (or "sub-subsets"): (20R1, 20R2 corresponding to one purchase order number) and (20R-3 corresponding to another purchase order number). Therefore, the # of POs in record 25R-1 is 2. Of course, this step could also be phrased in terms of identifying the number of unique purchase order numbers in each subset of records identified in step 3-2.

In step 3-6, the "# of line items" field in Summary Data 25 is populated by adding up the number of line unique line items in each corresponding subset identified in step 3-2. Note that since Basic Data 20 has one record for each line item number, the results of step 3-6 in this instance will simply be the number of records in each subset identified in step 3-2 (note the number "2" in the "Line Item Number" field of record 20R-2 of Basic Data 20 is an identification number, not a number of line items in that record; each record in Basic Data 20 contains a single line item). In

step 3-7, the "Orders On Time" field in Summary Data 25 is populated by adding up

the total number of sub-subsets identified in step 3-3 for which every record in the

sub-subset has a "Received Date" value that is earlier that its "Due Date" value. In

other words, an order is defined as on time if every line item in the order was

5   delivered on time. In step 3-8, the "Line Items On Time" field in Summary Data 25

is populated by, for each corresponding step 3-2 subset, summing together all the

records in which the "Received Date" is equal to or earlier than the "Due Date."

Those skilled in the art will recognize that process 30 represents just one

example of a series of steps that might be used to convert Basic Data 20 to Summary

10   Data 25. Also, those skilled in the art will recognized that first executable code used

to carry out a first step in process 30 might be the same code as second executable

code used to carry out a second step in process 30. For example, a single piece of

executable code might direct a computer to, for each record in Summary Data 25,

store in the "# of POs" field 25F-5, the value obtained by counting the records in

15   Basic Data 20 that have the same the same supplier name, start point, end point, and

buyer name as the corresponding Summary Data 25 record and that also have

identical purchase order numbers. Such a piece of code would be performing step 3-

5 of process 30, but would also implicitly be performing step 3-3 and 3-2. Thus, such

a piece of code could be said to be first code for performing step 3-2, second code for

20   performing step 3-3, and third code for performing step 3-5. Those skilled in the art

11

will recognize therefore that executable code may be organized in a variety of ways without departing from the spirit and scope of the present invention.

Furthermore, while process 30 works to convert Basic Data 20 into Summary Data 25, customer/buyers and suppliers might have basic purchase order data that is organized differently from the example of Basic Data 20. In such instances, those skilled in the art will recognize that executable code may, without undue experimentation, be written that will implement processes different that process 30 in order to convert basic data that is organized differently than Basic Data 20 into summary data similar to Summary Data 25.

It may also be noted that because the "Order Status" values in field 20F-10 of Basic Data 20 are "Closed" for each record, other data (e.g. received date) is available for each record. However, process 30 can be easily modified to handle the addition of data that includes some records that are incomplete because the "Order Status" value is "Open". As one example, process 30 might be modified to operate only on records whose status is "Closed." As one other example, process 30 might be modified to leave blank place holders in Summary Data 25 for records that cannot currently be completed (e.g., if all of the records in a subset identified in step 3-2 are "open", a place holder such as "--" might be inserted into Summary Data 25 fields that cannot be properly completed for the corresponding record in Summary Data 25, and then those records may be ignored or at least partially ignored when creating reports from Summary Data 25). In this manner, basic purchase order data such as

Basic Data 25 may be processed without having to first remove records for unclosed orders.

Figure 4 shows sample on-time performance report 40 that may be generated by the system of Figure 1. Report 40 includes tables 40a and 40b and reports on-time performance for a domestic supplier S1 during a reporting period. Display table 40a reports supplier S1's on time performance across all customer buyers providing data to for the system. Table 40a displays data for on time performance with respect to a plurality of start point / end point pairs. Table 40a includes records 40aR-1, 40aR-2, 40aR-3, and 40aR-4, corresponding, respectively, to the following start point/end point pairs in field 40aF-1: OS-CFD ("order sent" - "customer final destination") , OC-SSD ("order confirmed" - "supplier shipping dock"), OC-DTO ("order confirmed" - "destination transport onboard"), OC-CFD ("order confirmed" - "customer final destination"). In addition to start point / end point field 40aF-1, table 40a also includes field 40aF-2 ("No. of orders"), field 40aF-3 ("% on time"), field 40aF-4 ("No. of line items"), and field 40aF-5 ("% on time").

Display table 40b reports on time performance for orders placed with supplier S1 by customer/buyer C1. Table 40b displays data for on time performance with respect to a plurality of start point / end point pairs. Table 40b includes records 40bR-1, 40bR-2, 40bR-3, and 40bR-4, corresponding to, respectively, the following indicated start point / end point pairs in field 40bF-1. In addition to start point / end

point field 40bR-1, table 40b also includes field 40bF-2 ("No. of orders"), field 40bF-3 ("% on time"), field 40bF-4 ("No. of line items"), and field 40bF-5 ("% on time").

Figure 5 shows an exemplary process 50 that may be used to derive displayed Supplier Report 52 from Summarized Purchase Order Data ("Summary Data") 51. Supplier Report 52 is analogous to display table 40a in Figure 4, in that Supplier Report 52 is indicative of on time performance for a supplier S1 based on data from all supplier S1 customers providing data to the system. Summary Data 51 is analogous to Summary Data 25 of Figure 2b. Process 50 has steps 5-1 through 5-8. In step 5-1, an empty Supplier Report table 52 is created with the indicated fields. In step 5-2, subsets of data are identified in Summary Data 51, each record in a subset having the same supplier name, start point, and end point. Each subset of Summary Data 51 records identified in step 5-2 corresponds to a single record in Supplier Report 52 as indicated in step 5-3. In step 5-4, for each Supplier Report 52 record created in step 5-3, the "Start point / End point" field of Supplier Report 52 is populated with the start points and end points from the corresponding subset of Summary Data 51 records identified in step 5-2 (note, steps 5-3 and 5-4 are roughly analogous to the single step 3-2 illustrated and described in Figure 3 and accompanying text). In step 5-5 the "No. of POs" field in Supplier Report 52 is populated by adding up the values of the number of orders in each subset of Summary Data 51 records identified in step 5-2, and putting the respective totals in the corresponding record of Supplier Report 52. In step 5-6, the "% orders on time"

14

field of Supplier Report 52 is populated for each Supplier Report 52 record with percentages obtained by summing the orders on time values of Summary Data 51 records in the corresponding subsets identified in step 5-2, multiplying each by 100, and dividing each by the corresponding total obtained in step 5-5. In step 5-7, the "# of line items" field in Supplier Report 52 is populated by summing the number of line items value in each record of the corresponding subset identified in step 5-2. In step 5-8, the "% line items on time" field of Supplier Report 52 is populated for each Supplier Report 52 record with percentages obtained by summing the line items on time values of Summary Data 51 records in the corresponding subsets identified in step 5-2, multiplying each by 100, and dividing each by the corresponding totals obtained in step 5-7. Those skilled in the art will recognize that the number of line items or orders delivered on time may readily be reported as a percentage number, an absolute number, or both. Use of a percentage in a display report is desirable for facilitating subscribers to quickly compare on-time performance across several suppliers.

Those skilled in the art will recognize that process 50 represents just one example of a series of steps that might be used to convert Summary Data 51 into Supplier Report 52. Also, those skilled in the art will recognized that first executable code used to carry out a first step in process 50, might be the same code as second executable code used to carry out a second step in process 50.

Although process 50 shows steps for creating display data from summary data with respect to a particular supplier across all customer orders (i.e. display data analogous to table 40a of **Figure 4**), it does not show steps for creating display data from summary data with respect to a particular supplier across the orders of only one

5   customer (i.e., display data analogous to table 40b of **Figure 4**). The reason is that the display data for orders with respect to a single customer is already contained in a summary data table such as Summary Data 25 of **Figure 2**. To create a display table such as table 40b from summary data such as Summary Data 25, it will be understood that one need only pull up those records sharing the same supplier name and buyer

10   name, and display the on time results for each start point / end point pair. The only calculation needed is that of converting an number or orders or line items on time into a percentage. Therefore, such a process is not separately illustrated.

Although the examples disclosed in **Figures 2-5** show conversion of basic data into summary data which is stored and used to generate supplier reports, it will

15   be recognized by those skilled in the art that it is possible to only store data that is in a format that is close to the format of Basic Data 20 and still generate reports similar to report 40 of **Figure 4** without the intermediate step of creating and storing summary data such as Summary Data 25. For example, basic purchase order data such as Basic Data 20 might be received and modified only by adding new record

20   numbers to enforce uniqueness for adding to a common data base. Then a process would be written to derive reports such as report 40 directly from basic data such as

Basic Data 20. Although such an approach would not necessarily depart from the scope of the present invention, for operating a system such as system 10 on a large scale it is preferable for performance reasons to derive reports from a data base of summary data. Less storage space is needed and less processing time is needed to create display data from summary data than would be needed to create display data from basic order data.

Figure 6 shows a sample reject report 60 that may be generated by the system of Figure 1 using the decision flow illustrated in Figure 7 and accompanying text. Report 60 includes table 61 and reports reject performance for a domestic supplier S3 during a reporting period. Column 61-c1 shows reject performance information for items in orders placed with supplier S3 by customer C2. Column 61-c2 shows reject performance items in orders placed by all customers to supplier S3. Row 61-r1 shows total lots in orders placed (at the intersection of row 61-r1 and column 61-c1, this reflects total lots in orders placed by customer C2 to supplier S3, and at the intersection for row 61-r2 and column 61-c2 this reflects total lots in orders placed by customer C2). Row 61-r2 shows the percentage of lots in row 61-r1 that are rejected due to the supplier. Row 61-r3 shows the percentage of lots in row 61-r1 that are rejected to the to customer.

Figure 7 is a flow diagram illustrating predictive data elements and the predictions made by the system of Figure 1 about the cause of rejects based on those predictive data elements in a system implementing an aspect of the present invention.

17

The decision flow illustrated in **Figure 7** may be used to obtain a reject report such as reject report 60 of **Figure 6**. Customers and suppliers generally gather data that can be used in making a prediction about whether a reject was supplier caused or customer caused. Blocks 71a and 72-76 in **Figure 7** reflect predictive data elements

5   that can be used by a supplier performance reporting system to make a prediction and report a reject as either supplier caused or customer caused.

Beginning at the top of the flow diagram, if the item was not returned, the result of block 71 is "no." If the item was not returned, but payment was less than the invoice, the system indicates that the order has, in a sense, been "rejected" in that the

10   customer refused to pay the full amount. In such a case, the result of block 71a is "yes" and, as reflected by the arrow from block 71a to block 78, the system predicts and reports this rejection as supplier caused. If the payment was not less than the invoice and the item was not returned, than the result of block 71a is "no" and the system reports the order as not rejected as indicated by the arrow from block 71a to

15   block 71b.

If the order was returned, then the result of block 71 is "yes" as reflected by the arrow from block 71 to block 72. If the order was cancelled, the result of block 72 is "yes" and the reject is predicted and reported to be customer caused as indicated by the yes arrow from block 72 to block 77. If the answer is no, then, as illustrated

20   by the arrow from block 72 to block 73, the system next considers whether or not the same item that was ordered was reshipped after the return. If the item was reshipped,

then the result of block 73 is "yes" and the reject is predicted and reported to be

supplier caused as indicated by the arrow from block 73 to block 78. If the result of

block 73 is "no", then, as illustrated by the arrow from block 73 to block 74, the

system next considers whether or not the delivery was late. If the delivery was late,

5   the result of block 74 is "yes" and, as indicated by the arrow from block 74 to block

78, the reject is predicted and reported to be supplier caused. If the result of block 74

is "no", then, as illustrated by the arrow from block 74 to block 75, the system next

considers whether or not there was a purchase order ("PO")/ invoice mismatch. If

there was a PO/Invoice mismatch, then the result of block 75 is "yes" and, as

10   indicated by the arrow from block 75 to block 78, the reject is predicted and reported

as supplier caused. If the result of block 75 is "no", then, as illustrated by the arrow

from block 75 to block 76, the system next considers whether or not an item shipped

was defective. If an item shipped was defective, then the result of block 76 is "yes"

and, as indicated by the arrow from block 76 to block 78, and the return is predicted

15   and reported as supplier caused. If, however, the item shipped was not defective,

then the result of block 76 is "no" and, as indicated by the arrow from block 76 to

block 77, the return is predicted and reported as customer caused.

The order of blocks 72-76 may be varied. Note that if, for example, block 76

were not the last block, its "No" arrow would simply point to the next block rather

20   than to block 77.   If information is not available from either the supplier or

customer to make a determination for one or more of the blocks 72-76, a "No" answer

is delivered for those blocks with insufficient information and the remaining blocks are used to make a reject determination.

Executable code may instruct one or more computers to perform the processing steps illustrated in **Figure 7**. Those skilled in the art, many variations on executable code may be found that do not depart from the spirit and the scope of the present invention, but that, nevertheless, use predictive data elements to create reports analogous to the report illustrated in **Figure 6**, thereby allowing subscribers to evaluate reject performance in light of whether the rejects were supplier caused or customer caused.

Although particular embodiments have been described in detail, various modifications to the embodiments described herein may be made without departing from the spirit and scope of the present invention, thus, the invention is limited only by the appended claims.